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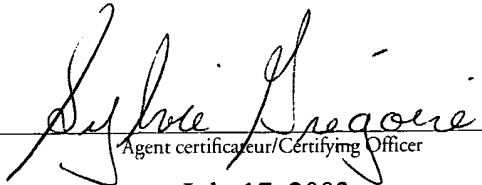
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Specification and Drawings, as originally filed, with Application for Patent Serial  
No: **2,392,809**, on July 9, 2002, by **CATENA NETWORKS INC.**, assignee of Brian  
MacIsaac and Greg Lehman, for "Parallel Software Download".

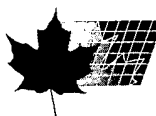
  
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## PARALLEL SOFTWARE DOWNLOAD

### **Background of Invention:**

Software upgrade to a system that contains multiple instances of the same hardware is time consuming. Each hardware entity must be upgraded individually. This problem is compounded when the system contains multiple hardware entities that require different software versions. As well, there is not enough RAM storage on the CE to hold a complete software image for any card.

Currently, the software upgrade process for a single hardware entity consists of opening an FTP session to a remote file server; transferring a new software load in small chunks to the Common Equipment of the system (temporarily); writing the software chunks into the specified hardware entities flash.

This process must be repeated for each hardware entity that requires the same upgraded software.

### **Detailed Technical Background:**

There are three entities involved in this process, the remote FTP server (which stores the software images), the CE card in the system, and the other cards. The CE card is a central control card that manages the various functions of the system and other cards. This is where the bulk of the management software resides (OAM&P).

The CE image management software establishes an FTP session to a remote server that contains the software image to be loaded onto the destination hardware entity (one of the other cards). The software is stored on the hardware entity in the form of a file. The destination file is opened on the hardware entity in preparation for the file transfer. The software image file stored on the remote server is downloaded in small chunks to the CE card. As a chunk arrives on the CE it is temporarily stored in RAM. The chunk is then transferred to the destination file on the hardware entity. The CE then retrieves the next chunk from the remote server and continues this process until the entire file is transferred. When the image has been completely transferred the file is closed and the FTP session is terminated. As shown in Figure 1.

This whole process is repeated for the next card that requires the same software image, including establishing a new FTP session and transferring the file across the network, etc.

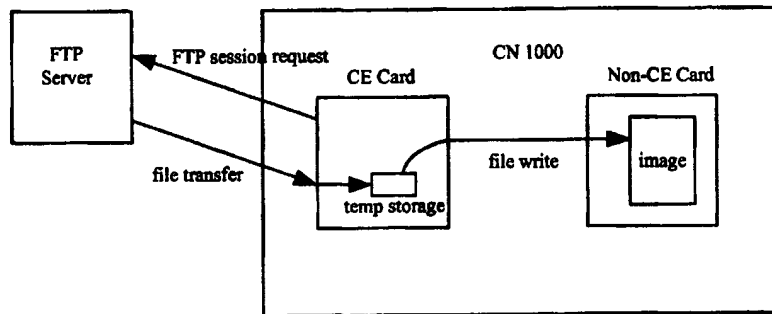


Figure 1.

**Description of Invention:**

This invention increases the performance of the software upgrade function and more importantly reduces the overall time required to upgrade a system.

Software components consist of:

- A single transfer agent (e.g. a task, or thread of execution) that manages the transfer of the software image from the FTP server unto the temporary buffer storage on the CE
- Multiple download agents to handle the transfer of the chunks contained in the buffer pool to the hardware entities. (Note that there is one task per hardware entity. For instance, if a system is comprised of 20 line cards of the same type, then 20 tasks are created.)
- A family of dynamic buffer pools which are used to temporarily store the chunks of a transferred software image. The management software can control the number of buffers in the pool as well as the individual buffer size.

The above architecture can be leveraged such that a "grouping" exists for each distinct card type in a system.

The challenge to the management software is to ensure that the transfer agent fills the pools just ahead of the emptying of them by the multiple download agents. The management software can adjust the buffer pool depth to trade off required RAM vs. performance. This balance is necessary due to the real-time processor impact and responsiveness, as well as the lack of available RAM.

An FTP session is established for the duration of the transfer (of a software image), and the image file is "chunked" and transferred to a family of dynamically allocated buffer pools. This is transferred once to the CE temporary storage (in chunks). Each chunk of the image file is written to multiple hardware entities at the same time. Refer to Figure 2.

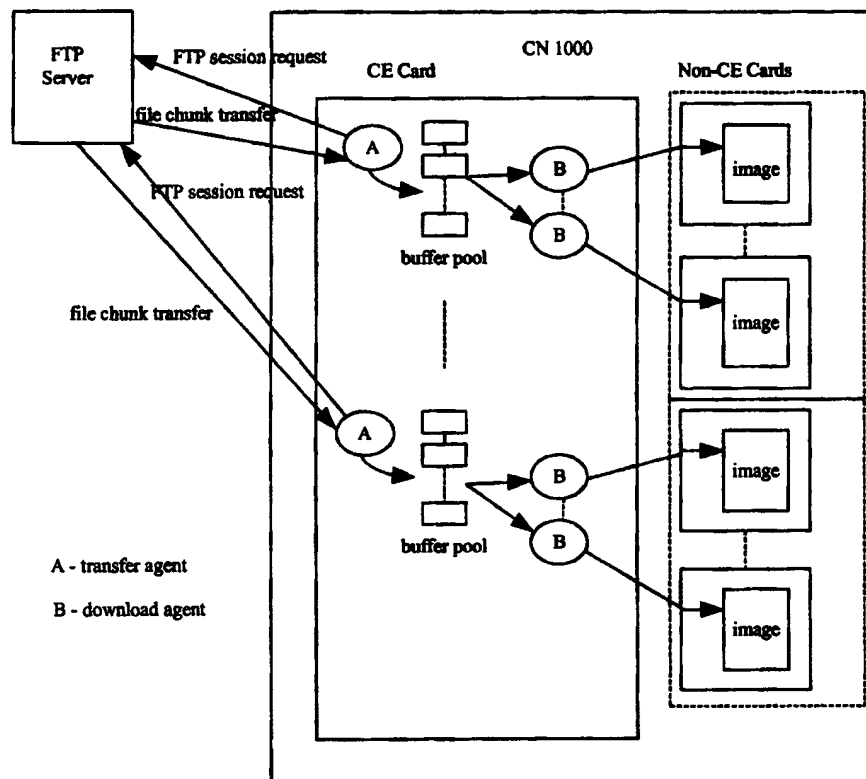


Figure 2

A variation on the invention would allow the CE image management software to read a previously transferred image from one of the hardware entities and write it into multiple similar hardware entities instead of transferring the file from the remote server.

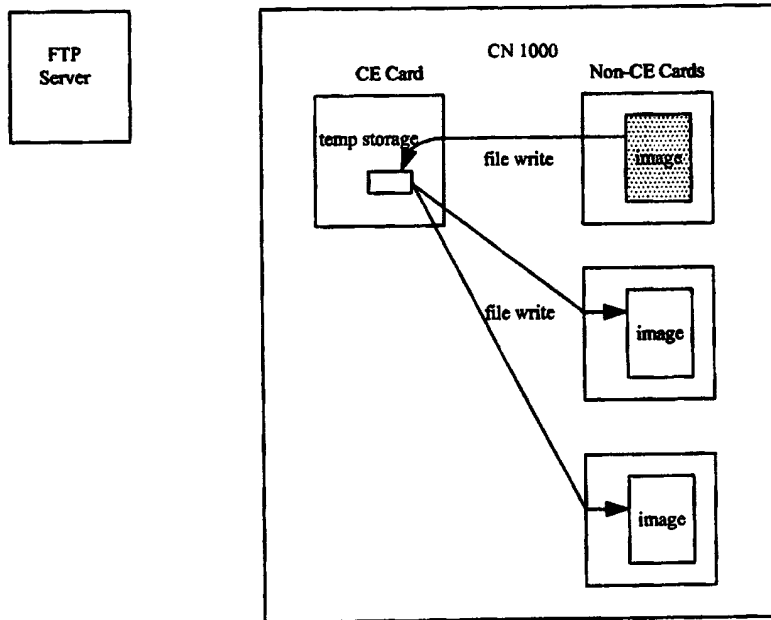


Figure 3

The invention provides

1. The ability to upgrade multiple like hardware entities with the same software image, while requiring only one image transfer from a remote server.
2. The ability to dynamically control the RAM used on the CE card and the overall transfer performance.
3. The ability to upgrade one or more like hardware entities by using a previously transferred software image from another similar hardware entity.